Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Journal of Affective Disorders 325 (2023) 596–603

Contents lists available at ScienceDirect

Journal of Affective Disorders

journal homepage: www.elsevier.com/locate/jad

Research paper

The association between sociodemographic inequalities, COVID-related impacts and mental health

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ARTICLE INFO

Keywords:
COVID-19
Mental health
Anxiety
Depression
Social determinants
Household income

ABSTRACT

Purpose: There are concerns that the social, economic and health impacts of COVID-19 are unevenly distributed, exacerbating existing inequalities. Here we tested the hypotheses that: (H1) the magnitude of these impacts would be associated with symptoms of depression and anxiety early in the pandemic, and (H2) that these impacts would be associated with a range of sociodemographic risk factors.

Methods: Cross-sectional self-report data were collected from a UK sample ($N = 632$) between the 16th of May and 21st of July 2020, coinciding with the early stages of the pandemic and first UK lockdown. Data were collected on COVID-19 related impacts including financial and social stressors, symptoms of anxiety and depression, and sociodemographic/economic risk factors operationalised at multiple levels including the individual, familial, household and neighbourhood.

Results: Using regression analyses both financial and social impacts were independently associated with anxiety ($R^2 = 0.23$) and depression scores ($R^2 = 0.24$), as well as clinically significant generalised anxiety ($R^2 = 0.14$) and depression ($R^2 = 0.11$). In addition, many sociodemographic factors were associated with elevated levels of COVID-19 related impacts, including being younger, female, having lower educational attainment and lower income.

Limitations: The main limitations of the study were its modest sample size, cross sectional design (which precluded inferences about directions of causality), and the relatively high socioeconomic status of the sample (which limited generalisability).

Conclusions: These findings are consistent with a growing body of evidence that suggests that the pandemic has exacerbated existing inequalities, and further, point to particular groups that should be supported by post-COVID-19 recovery policies and initiatives.

1. Introduction

The coronavirus disease 2019, i.e. COVID-19, is a disease caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) strain of coronavirus, and was discovered in Wuhan (China) in December 2019. Profound impacts of the subsequent COVID-19 pandemic and associated restrictions are evident across the globe, not least in the UK, which experienced particularly high levels of excess deaths/case numbers prior to the development of vaccines (Beaney et al., 2020). For example, according to an analysis of the "worst" 11-week period during the pandemic (i.e. encompassing the highest excess mortality rate), the UK experienced 64,451 excess deaths, representing a 52 % elevation relative to "usual deaths" in prior years (The Health Foundation, 2020). For reference, comparable data from France and Germany suggest that the impact of the pandemic in these countries was less than half/less than a tenth of this, respectively. Further, there is strong evidence that the burden of the pandemic has not been equally distributed across the population, but has revealed and exacerbated existing social inequalities (Paremoer et al., 2021; Blundell et al., 2020), which risk being replayed with respect to vaccine delivery and uptake (Black et al., 2021). For example, the risk of dying from COVID-19 amongst ethnic minorities is approximately double what it is amongst

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https://doi.org/10.1016/j.jad.2023.01.037
Received 5 November 2021; Received in revised form 5 January 2023; Accepted 8 January 2023
Available online 18 January 2023

White British, even after controlling for potential confounders (Razai et al., 2021; Public Health England, 2020a; Williamson et al., 2020).

The impacts of the pandemic are not limited to such direct consequences on physical health and mortality, however, but include social, economic and mental health costs, the long-term implications of which remain to be seen (HM Government, 2020). For example, the UK Gross Domestic Product (GDP; an index of the market value of services and goods produced and sold during a defined period) contracted by 9.9 % in 2020, representing the greatest annual fall on record (Office for National Statistics, 2021a). These economic consequences also appear to disproportionately impact certain segments of the population. Whilst employment levels fell by 0.5 % amongst 25–64 year olds since March 2020, for 16–24 year olds they fell by 6 % (Francis-Devine et al., 2021). Further, employment sectors that have been particularly impacted by the pandemic, e.g. accommodation and food services (Allas et al., 2020), have disproportionately employed women, ethnic minorities, younger adults and the lower paid (Francis-Devine et al., 2021).

In terms of the social impacts of COVID-19 and associated social distancing measures employed to contain its spread, a similar picture emerges. Whilst women, younger adults, ethnic minorities and individuals living alone have been linked to a higher risk of loneliness in pre-pandemic analyses (see (Office for National Statistics, 2018) for example), evidence suggests that these groups are more vulnerable during the pandemic, highlighting potential amplification in at-risk groups (Bu et al., 2020; Etheridge and Spantig, 2020). For a number of reasons individuals with pre-existing mental and/or physical health conditions may also be more susceptible to the impacts of social distancing, e.g. due to a greater reliance on support and sense of themselves as a burden to others (Office for National Statistics, 2020).

With respect to mental health, once again, the findings largely mirror associations seen in terms of economic and social impacts. Thus, increases in common mental health difficulties since the start of the pandemic, e.g. anxiety and depression, appear to disproportionately affect particular groups (Shevlin et al., 2020; Hyland et al., 2020). For example, being young and female (Hyland et al., 2020; Daly et al., 2020; Niedzwiedz et al., 2021; Jia et al., 2020; Fancourt et al., 2020; Office for National Statistics, 2021b; Ellwardt and Präg, 2021; Smith et al., 2020; Hubbard et al., 2021; Kwong et al., 2020; Saunders et al., 2020) or of non-White ethnicity (Niedzwiedz et al., 2021; Fancourt et al., 2020; Pierce et al., 2021; Nandi and Platt, 2020), being economically disadvantaged (Shevlin et al., 2020; Fancourt et al., 2020; Ellwardt and Präg, 2021; Smith et al., 2020; Hubbard et al., 2021; Kwong et al., 2020; Saunders et al., 2020; Pierce et al., 2021) and/or having a pre-existing mental or physical health condition (Fancourt et al., 2020; Ellwardt and Präg, 2021; Kwong et al., 2020; Saunders et al., 2020; Pierce et al., 2021) have typically (though not always) been linked to higher mental health difficulties and psychological distress during the pandemic, as well as a greater deterioration in mental health.

The similarity in findings across these domains of physical health and mortality, economics and wellbeing, raises the possibility that common or overlapping mechanisms underlie these effects. One possible explanation is that the pandemic increases a range of general contextual stressors, e.g. financial, practical, and social (Robillard et al., 2020), which interact with existing inequalities to disproportionately affect high-risk groups, with consequences for mental health. In line with this, there is a large canon of pre-COVID-19 research linking a range of general stressors, including financial stress and social isolation, to common mental health difficulties (Schneiderman et al., 2005; Leigh-Hunt et al., 2017). However, very little is known about how such stressors operate on the population and interact with existing inequalities in the context of the pandemic.

As an example of how such disparities may be exacerbated during the pandemic, entrenched gender inequalities seen in the home may be amplified during the pandemic, with women disproportionately shouldering the burden of housework, unpaid care work and home-schooling (during school closures), often whilst simultaneously juggling work responsibilities (Racine et al., 2021; Xue and McMunn, 2021). Likewise, individuals in low-income groups or low-prestige roles are less likely to have savings to buffer the financial impacts of the pandemic, and may be forced to continue working (often in high exposure roles) irrespective of risks of infection (Shevlin et al., 2020; Hyland et al., 2020; Lopes and Jaspal, 2020), and further, with less job security, are likely to be amongst those first affected by job cuts and furloughing of roles (Allas et al., 2020; Witteveen and Velthorst, 2020).

1.1. Focus of this study

The University College London (UCL) COVID-19 Impacts Study was launched to assess the social, economic and mental health consequences of COVID-19 in a UK population sample. The study reported represents a cross-sectional analysis of data gathered between May and July 2020, which explored COVID-19 related impacts and their association with common mental health difficulties. Specifically, we hypothesised that (H1) the magnitude of practical, economic and social impacts would predict symptoms of (H1a) depression and (H1b) anxiety at the start of the pandemic, and further, (H2) that these impacts would be unevenly distributed across the population, i.e. be predicted by a range of sociodemographic risk factors. To this end, we explored a range of impacts relating *to practical/financial* adversity (e.g. difficulties accessing food, medication and the internet), as well as *social* adversity (e.g. a lack of physical affection, or interpersonal conflict). With respect to risk factors, we included a number of individual-level sociodemographic and socioeconomic variables based on the existing literature, including age, gender and ethnicity. In addition, drawing on a growing body of research and theory that emphasises the importance of social determinants of mental health at *multiple* levels, we also explored the role of individual-, familial-, household- and neighbourhood-level risk and resilience factors.

2. Methods

2.1. Participants, recruitment and data collection

Participants were recruited through social media posts, advertisements and participant databases held by the authors, with all data collected between the 16th of May and 21st of July 2020. The survey was presented, and informed consent taken, online within the Qualtrics survey environment. Participation was voluntary, with an opt-in £10 prize draw. Participants had to be 18 or over to take part. Ethical approval was obtained through the UCL Research Ethics Committee (approval number: 18335/001), and as such, the study has been undertaken in line with ethical standards stated in the 1964 Declaration of Helsinki as well as amendments thereof.

2.2. Measures

See Supplementary Table 1 for full details of data collected and questionnaires administered including response options. Brief details are provided below.

2.3. COVID-19 related impacts

Participants were asked about their experience (in the past two months) of difficulties in relation to finances, access to food, access to medication or medical treatment, poor internet access, feeling overcrowded and a lack of physical affection or contact.

2.4. Mental health

Mental health symptoms were measured using established and validated standardised measures of anxiety and depression: the Patient Health Questionnaire (PHQ-9) (Kroenke et al., 2001) and Generalized

Anxiety Disorder Scale (GAD-7) (Spitzer et al., 2006).

2.5. Risks and resiliencies

Sociodemographic and socioeconomic risk and resilience predictors were explored at multiple levels and grouped into categories including: *demographic* (age, gender and ethnicity), *individual-level risk* (subjective and objective risk of COVID-19 infection, disability, mental health difficulties), *socioeconomic* (education, employment status, household income), *family structure* (relationship status, number of children, caregiving status), and *household/neighbourhood level variables* [housing status (i.e. rented, shared, temporary or other, council/supported), number of rooms, access to outdoor space, ward level index of multiple deprivation (IMD) decile, having neighbours to socialise with and rely on in an emergency].

2.6. Analyses

To explore covariance between the seven impact items and reduce the data an exploratory factor analysis was undertaken with principal-components factoring. An oblique (promax) rotation was used, since we expected extracted factors to be correlated. All factors with eigenvalues >1 were retained. (Note: eigenvalues are indices of the variance explained by an extracted factor; hence, a value >1 indicates that a factor has greater predictive power than any single observed variable by itself).

To determine the association between impact scores and mental health symptoms, PHQ-9 and GAD-7 (raw) scores and clinical caseness for depression and generalised anxiety (specified using a clinical cut-off score of ≥10 on both measures) were regressed on extracted impact factors using linear and logistic regression analyses (respectively), with all identified impact factors added simultaneously.

In the next phase of analyses extracted impact factors were regressed on sociodemographic and socioeconomic risk and resilience factors outlined above. In order to best utilise the large number of sociodemographic and socioeconomic variables included in the study a multi-stage analysis approach was adopted. First, data were analysed using univariate linear regression analyses, thereby assessing for zero-order associations (Model 1 – *univariate models*). In Model 2 (*partial multivariate models*) all predictors were assessed for inclusion through forward stepwise selection analyses. These were run separately for each predictor category (*demographic, individual risk, socioeconomic, family, household/neighbourhood*), allowing for identification of the most significant/robust indicators from within each variable category, since we predicted there would be a high degree of correlation between many predictors. Variables were first excluded if they did not independently improve the fit of the model according to a likelihood ratio test (LRT) ($p > 0.05$) (Lewis et al., 2011). Predictors that remained were then sequentially added to the model based on the strength of their association with the outcome variable (assessed using Akaike's Information Criterion [AIC]) and only retained if they significantly increased the variance explained (LRT) ($p < 0.05$).

Finally, *full multivariate models* (Model 3) were run, with all variables retained from each variable category (identified in Model 2) added simultaneously. This allowed us to determine whether, for example, household/neighbourhood factors remained significant after controlling for key individual level socioeconomic factors. Since IMD was measured at the Lower Layer Super Output Area (LSOA) level (a grouping of 400–1200 households), analyses that included this variable were re-run using multi-level modelling, with data specified at two levels: LSOA level (IMD) and individual level (all other variables). As there were no substantial differences in the coefficient values between models using this approach we reported findings from single level regression analyses only. Whilst age was recorded as ordinal, it was treated as continuous in regression models since it included eight categories and step sizes were equal in size (Pasta, 2009). Due to their low frequency (<5 %), 'prefer not to say' and missing data response categories were not included in the analyses.

All statistics were undertaken using Stata (V.14; StataCorp, College Station, TX). To reduce the risk of type 1 errors (i.e. false positives), *Bonferroni* corrections were undertaken for univariate analyses, with corrections made *within* each variable category. Specifically, corrected alpha criterion values of 0.0167, 0.0125, 0.0167, 0.0167 and 0.0083 were defined for demographic, individual risk, socioeconomic, family and household/neighbourhood variables, respectively, reflecting inclusion of three, four, three, three and six variables (and hence multiple comparisons) within each variable category, respectively. *Bonferroni* corrections were *not* undertaken for multivariate analyses, since these simultaneously controlled for variance across multiple variables/variable categories, and hence already represented a relatively stringent test of significance.

3. Results

Table 1 presents a summary of individual level variables for the entire sample ($n = 632$). The modal age was 40–49 years, which made up 34.5 % of our sample ($n = 218$). Participants were predominantly female ($n = 534$, 84.5 %), white ($n = 544$, 86.1 %), employed ($n = 482$, 76.3 %), highly educated, with >80 % having an undergraduate degree or higher level of education ($n = 509$, 80.5 %) and affluent, i.e. earning a relatively high wage, with 36.7 % earning £64,000 or higher ($n = 232$). With respect to individual risk factors, 15.7 % ($n = 99$) reported believing that they were at a high risk from COVID-19, and 17.1 % ($n = 108$) reported having a medical condition linked to higher risks from COVID-19. With respect to mental health, the median PHQ-9 score was 6 (interquartile range = 2–9) and the median GAD-7 score was 6 (IQR = 3–10) (mild range). The estimated prevalence of clinical depression and anxiety in our sample were 25.0 % and 32.6 %, respectively. See Table 2 for a summary of family and household/neighbourhood-level variables in the sample.

3.1. Financial and social impacts predict mental health symptoms

Principal-components factoring of all seven impact scores (finance, food, medication, internet, overcrowding, conflict and lack of affection) resulted in the extraction of two components, which together explained 49.8 % of the variance in scores (see Table 3). Factor 1 (explaining 32.6 % of the variance), which we labelled *essential impacts*, included loadings from finance, food and medication items. Factor 2 (explaining 17.2 % of the variance), which we labelled *social impacts*, included loadings from *overcrowding*, *conflict* and *lack of affection*. 'Difficulties with accessing the internet' was the only item not to load sufficiently on either of the factors and were therefore excluded.

Next, we explored the extent to which these *impacts* (added simultaneously) were associated with variance in mental health symptoms using linear regression. Models that included *essential* and *social impacts* predicted significant variance in PHQ-9 scores ($F_{(2,581)} = 90.36$, $p < 0.001$, $R^2 = 0.24$) as well as GAD-7 scores ($F_{(2,596)} = 90.63$, $p < 0.001$, $R^2 = 0.23$), with *essential impacts* and *social impacts* each predicting independent variance in scores, i.e. higher levels of *essential impacts* and *social impacts* predicted higher symptoms of depression (coefficient = 1.59, 95%CIs = 1.12;2.05, $p < 0.001$; coefficient = 1.93, 95%CIs = 1.47;2.39, $p < 0.001$) and generalised anxiety (coefficient = 1.27, 95% CIs = 0.86;1.67, $p < 0.001$; coefficient = 1.82, 95%CIs = 1.41;2.22, $p < 0.001$). *Essential* and *social impact* scores also predicted caseness for depression ($\chi^2_{(613)} = 81.54$, $p < 0.001$, $R^2 = 0.11$; Odds Ratio (OR) = 1.72, 95%CIs = 1.41; 2.08, $p < 0.001$; OR = 1.59, 95%CIs = 1.31; 1.92, $p < 0.001$) and generalised anxiety ($\chi^2_{(613)} = 94.17$, $p < 0.001$, $R^2 = 0.14$; OR = 1.56, 95%CIs = 1.28;1.92, $p < 0.001$; OR = 1.98, 95%CIs = 1.62; 2.44, $p < 0.001$).

Table 1
Summary of individual-level variables. Includes scores on mental health measures (PHQ-9 and GAD-7) as well as demographic, individual risk and socioeconomic factors. PNS = 'prefer not to say'; PHQ-9 = Patient Health Questionnaire; GAD-7 = Generalized Anxiety Disorder Scale; MH = mental health.

Variable		N (%) or median (IQR)*
Mental health:		
PHQ-9	–	6 (2–9)*
GAD-7	–	6 (3–10)*
Demographic:		
Age	18–21	11 (1.74)
	22–29	70 (11.08)
	20–39	127 (20.09)
	40–49	218 (34.49)
	50–59	132 (20.89)
	60–69	62 (9.81)
	70–79	11 (1.74)
	80+	1 (0.16)
Gender	Female	534 (84.45)
	Male or other	96 (15.19)
	PNS	2 (0.32)
Ethnicity	White	544 (86.08)
	Mixed	26 (4.11)
	Black	17 (2.69)
	Asian	38 (6.01)
	Other	7 (1.11)
Individual risk:		
Subjective risk (no)	Yes	99 (15.66)
	No	478 (75.63)
	Not sure	51 (8.07)
	PNS	4 (0.63)
Objective risk	Yes	108 (17.09)
	No	516 (81.65)
	PNS	8 (1.27)
Disability	Yes	25 (3.96)
	No	599 (94.78)
	PNS	8 (1.27)
MH difficulties	Yes	256 (40.51)
	No	372 (58.86)
	PNS	4 (0.63)
Socioeconomic:		
Employment	Unemployed	20 (3.16)
	Employed	482 (76.27)
	Studying	34 (5.38)
	Retired	33 (5.22)
	Homemaker	29 (5.59)
	Other	26 (4.11)
	PNS	8 (1.27)
Education	A levels or lower	121 (19.15)
	Undergraduate	255 (40.35)
	Postgraduate	254 (40.19)
	PNS	2 (0.32)
Income	<£19,000	69 (10.92)
	£19–31,999	82 (13)
	£32–63,999	177 (28)
	≥£64,000	232 (36.71)
	PNS	72 (11.39)

* Indicates items for which interquartile range is presented rather than median.

3.2. Essential impacts are differentially associated with sociodemographic risk factors

Supplementary Table 2 shows univariate analyses, with COVID-19 *essential impacts* regressed on individual predictors. Being female, from a mixed ethnicity (relative to White), reporting higher objective and subjective risk, having a disability or mental health difficulty (current or historic), being single (relative to cohabiting within a romantic relationship), being a carer (to someone either inside or outside the home), living in rented or council/supported housing (relative to an owned home), living in a smaller residence (with 1–3, compared to 7–9 or 10+ rooms), and living in a neighbourhood that is more deprived were all associated with elevated *essential impacts*. In contrast, being employed, studying or retired (relative to being unemployed), having a higher level of education or income, and having more neighbours to socialise with and rely on in an emergency were all linked to lower *essential impacts*. Further, all of these effects survived *Bonferroni* correction for multiple comparisons (as outlined in the Methods section), with the exception of living in a smaller residence and living in a neighbourhood that is more deprived.

However, only a subset of factors survived after we included demographic, individual risk, socioeconomic, familial, and household/neighbourhood-related variables in a final multivariate model (Table 4), which predicted 20.7 % of the variance in the *essential stressor* scores ($F_{(25,552)} = 5.77$, $p < 0.001$, $R^2 = 0.21$). In this final model, being female (coefficient = −0.25, 95%CIs = −0.45; -0.04, $p = 0.02$), reporting higher objective risk (coefficient = 0.33, 95%CIs = 0.11;0.54,

Table 2
Summary of family- and household/neighbourhood-level variables. IMD = Index of Multiple Deprivation; PNS = 'prefer not to say'; relationship apart = in a relationship but living apart; relationship together = in a relationship and living together.

Variable		N (%) or median (IQR)*
Family:		
Relationship status	Single	123 (19.46)
	NA or other	20 (3.16)
	Relationship apart	49 (7.75)
	Relationship together	434 (68.67)
	PNS	6 (0.95)
Number of children	–	1 (0–2)*
Carer status	Not a carer	538 (85.13)
	Carer outside home	55 (8.7)
	Carer inside home	32 (5.06)
	PNS	7 (1.1)
House/neighbourhood:		
Housing status	Owned	427 (67.56)
	Rented	137 (21.68)
	Shared	19 (3)
	Temporary or NA	16 (2.53)
	Council/supported	23 (3.64)
	PNS	10 (1.58)
Number of rooms	1–3	96 (15.53)
	4–6	244 (39.48)
	7–9	194 (31.39)
	10+	84 (13.59)
Outdoor space	Yes	565 (89.4)
	No	55 (8.7)
	PNS	12 (1.9)
IMD decile	–	7 (4–9)*
Friendly neighbours	–	3 (1–5)*
Emergency neighbours	No	238 (37.66)
	Yes	373 (59.01)
	PNS	21 (3.32)

* Indicates items for which interquartile range is presented rather than median.

Table 3
Factor loadings from factor analysis of COVID-19 impacts. Loadings >0.4 are highlighted in bold as per convention, since these are considered to be stable; see (Guadagnoli and Velicer, 1988) for example.

COVID-19 impact items	Factor 1 – Essential impacts	Factor 2 – Social impacts
Finance	**0.56**	0.09
Food	**0.81**	−0.05
Medication	**0.86**	−0.15
Internet	0.23	0.33
Overcrowding	−0.09	**0.83**
Conflict	−0.11	**0.86**
Affection	0.19	**0.43**

Table 4
Full multivariate regression of Essential Impacts and Social Impacts on predictor variables. For ordinal variables base category is presented in brackets. MH = mental health; Relationship apart = in a relationship but living apart; Relationship together = in a relationship and living together.

Predictor	Level	Essential impacts multivariate analysis		Social impacts multivariate analysis	
		Coefficient (95 % CIs)	P value	Coefficient (95 % CIs)	P value
Demographics:					
Age	–	–	–	**−0.13 (−0.21; -0.06)**	**0.001**
Gender (female)	Male or Other	**−0.25 (−0.45; -0.04)**	**0.02**	–	–
Individual risk:					
Objective risk (no)	Yes	**0.33 (0.11; 0.54)**	**<0.01**	–	–
Disability (no)	Yes	0.34 (−0.04; 0.73)	0.08	–	–
MH difficulties (no)	Yes	–	–	**0.18 (0.02; 0.34)**	**0.03**
Socioeconomic:					
Employment (unemployed)	Employed	−0.43 (−0.89; 0.02)	0.06	0.02 (−0.44; 0.47)	0.94
	Studying	−0.38 (−0.93; 0.17)	0.18	0.2 (−0.37; 0.76)	0.5
	Retired	**−0.64 (−1.19; −0.08)**	**0.03**	0.08 (−0.5; 0.66)	0.77
	Homemaker	-0.08 (−0.65; 0.49)	0.78	−0.19 (−0.76; 0.39)	0.52
	Other	−0.12 (−0.68; 0.45)	0.69	0.21 (−0.37; 0.78)	0.48
Education (A levels or lower)	Undergraduate	**−0.24 (−0.45; -0.02)**	**0.03**	–	–
	Postgraduate	−0.16 (−0.39–0.06)	0.15	–	–
Income (<19,000)	£19–31,999	**−0.39 (−0.7; -0.07)**	**0.02**	–	–
	£32–63,999	**−0.49 (−0.79; -0.19)**	**<0.01**	–	–
	≥£64,000	**−0.64 (−0.94; -0.33)**	**<0.001**	–	–
	Other	**−0.55 (−0.91; -0.19)**	**<0.01**	–	–
Family structure:				–	–
Relationship status (single)	Other	0.16 (−0.32; 0.64)	0.52	–	–
	Relationship apart	**0.39 (0.06; 0.72)**	**0.02**	–	–
	Relationship together	0.18 (−0.05; 0.41)	0.14	–	–
Total number of children	–	–	–	**0.19 (0.11; 0.26)**	**<0.001**
Caregiving status (not)	Carer outside home	**0.38 (0.1; 0.66)**	**<0.01**	**0.49 (0.2; 0.77)**	**0.001**
	Carer inside home	**0.49 (0.14; 0.84)**	**<0.01**	0.33 (−0.04; 0.69)	0.08
House/neighbourhood:				–	–
Housing status (owned)	Rented	**0.23 (0.04; 0.43)**	**0.02**	–	–
	Shared	−0.05 (−0.5; 0.39)	0.81	–	–
	Temporary or other	0.19 (−0.31; 0.68)	0.47	–	–
	Council/supported	**0.62 (0.17; 1.06)**	**<0.01**	–	–
IMD decile	–	−0.01 (−0.04; 0.02)	0.55	−0.03 (−0.06; 0)	0.07
Friendly neighbours	–	–	–	**−0.05 (−0.11; 0)**	**0.04**
Emergency neighbours (no)	–	**−0.2 (−0.36; -0.03)**	**0.02**	−0.08 (−0.26; 0.1)	0.4

Items in bold are significant at p<0.05 level (minimum).

$p < 0.01$), being a carer (either inside or outside the home) (coefficient = 0.49, 95%CIs = 0.14;0.84, $p < 0.01$; coefficient = 0.38, 95%CIs = 0.1;0.66, $p < 0.01$) and living in rented or council accommodation (relative to residing in an owned home) (coefficient = 0.23, 95%CIs = 0.04;0.43, p = 0.02; coefficient = 0.62, 95%CIs = 0.17;1.06, $p < 0.01$) were all linked to higher *essential impacts*. In contrast, having an intermediate level of education (undergraduate relative to A′ levels or lower) (coefficient = −0.24, 95%CIs = −0.45; -0.02, $p = 0.03$) and having neighbours that can be called upon in an emergency (coefficient = −0.2, 95%CIs = −0.36; −0.03, p = 0.02) were all associated with lower *essential impacts*. Finally, relative to the lowest income bracket (<£19,000) each incremental income bracket was associated with a stepwise reduction in *essential impacts* across all levels up to the highest (≥£64,000) (coefficient = −0.64, 95%CIs = −0.94; -0.33, $p < 0.001$). In the final multivariate model cohabiting in a relationship was no longer significant; however, being in a relationship apart (relative to being single) emerged as a significant predictor of higher *essential impacts* (coefficient = 0.39, 95%CIs = 0.06;0.72, p = 0.02).

3.3. Social impacts are differentially associated with sociodemographic risk factors

With respect to *social impacts*, univariate analyses indicated that being younger, having a mental health difficulty (current or historic), being in a relationship but living apart (relative to being single), having more children, being a carer (outside the home), living in rented accommodation (relative to an owned home), living in a smaller residence (with 1–3, compared to 7–9 or 10+ rooms) and living in a more deprived neighbourhood were all associated with elevated COVID-19 *social impacts*. In contrast, having access to outdoor space and having more neighbours to socialise with and rely on in an emergency were linked to lower *social impacts*. Further, all of these effects survived *Bonferroni* correction for multiple comparisons (as outlined in the Methods section), with the exception of being in a relationship but living apart, living in a smaller residence, and having neighbours to rely on in an emergency.

A subset of these remained significant after we included demographic, individual risk, socioeconomic, family-related, and household/neighbourhood-related factors in a final multivariate model (Table 4), which predicted 13.3 % of the variance in *social stressor* scores ($F_{(13,574)} = 6.79$, $p < 0.001$, $R^2 = 0.13$). In this final model, being younger (coefficient = −0.13, 95%CIs = −0.21; −0.06, $p = 0.001$), having a mental health difficulty (current or historic) (coefficient = 0.18, 95%CIs = 0.02;0.34, p = 0.03), having more children (coefficient = 0.19, 95%CIs = 0.11; 0.26, $p < 0.001$) and being a carer (outside the home) (coefficient = 0.49, 95%CIs = 0.2; 0.77, p = 0.001) were all associated with elevated *social impacts*. In contrast, having more neighbours to socialise with was linked to lower *social impacts* (coefficient = −0.05, CIs = −0.11; 0, $p = 0.04$).

4. Discussion

All hypotheses were supported: both *social* and *essential* impacts experienced at the start of the pandemic were associated with higher symptoms of –and caseness for- depression (H1a) and anxiety (H1b). Further, a range of sociodemographic and socioeconomic risk factors, conceptualised at multiple levels, were differentially associated with these impacts (H2). Broadly speaking, the findings suggest that being

younger, female, having pre-existing mental health difficulties, having lower educational attainment, earning less, being a carer, living in less stable/impermanent accommodation, and having less access to social support are associated with greater COVID-19 related impacts.

With respect to the levels of depression and anxiety seen in our population sample (25 % and 32.59 %, respectively) these are broadly consistent with previous findings, including a systematic review and meta-analysis of worldwide data up to May 2020, which reported rates of 33.7 % (95 % CIs: 27.5–36.7) and 31.97 % (95 % CIs: 27.5–40.6) for depression and anxiety, respectively (Salari et al., 2020). With respect to the predictors of these symptoms/mental health difficulties, the findings reported support previous *pre*-COVID-19 research, which has emphasised the importance of the social determinants of mental health (Silva et al., 2016), as well as COVID-19 focused research that has highlighted how minoritized, marginalised and disempowered groups have been disproportionately affected by the pandemic (Blundell et al., 2020). Expanding on this research, however, our findings also suggest potential pathways through which these effects may operate. Thus, particular groups may be disproportionately affected by the pandemic (at least in part) through heightened exposure to its social, economic and practical impacts, as well as reduced access to social, economic and practical support.

With respect to the particular pattern of associations we report, whilst there was some overlap in the pattern of risk factors that predicted *essential* and *social impacts* in the univariate analyses, the full multivariate models, which retained only the most significant/robust predictors highlighted largely independent patterns of association. Thus, in the full multivariate models only being a carer to someone outside the home was associated with both *essential* and *social* impacts.

Interestingly, *essential* impacts were differentially associated with a greater range of risk factors than were *social* impacts. This may reflect an exacerbation of pre-existing economic inequalities amongst certain groups, which came to dominate individuals' concerns, potentially to the exclusion of all others: for example, greater job loss, furloughing of roles and closure of industry sectors amongst those with low employment security and increased housing instability amongst those who do not own their own home (Blundell et al., 2020). Thus, essential impacts were linked to a number of indices of socioeconomic status, with participants from higher income groups, those with an intermediate (undergraduate) level of education (relative to those *without* a university education) as well as the retired, exhibiting lower essential impacts scores. Conversely, relative to homeowners, participants who lived in rented or council/supported accommodation reported greater essential impacts. Individuals in relationships who lived apart also reported higher essential impacts potentially reflecting couples whose financial constraints preclude buying a home together, and/or the lack of savings that typically come from cohabiting and sharing bills etc.

Being female was also associated with greater *essential* but not *social* impacts. This is consistent with a body of literature that shows that women *generally* fare worse financially (i.e. before the pandemic), but have also had their livelihoods more severely impacted by COVID-19. For example, a recent report by the United Nations highlighted that in the 25 to 34 year age bracket women around the world are 25 % more likely than men to live in extreme poverty (United Nations, 2020), and women are far more likely to have been furloughed and/or worked in sectors that have been disproportionately impacted by the economic downturn (Allas et al., 2020; Witteveen and Velthorst, 2020).

Being at a higher (objective) risk of COVID-19 infection and being a carer to someone inside the home were also associated with higher *essential* -rather than *social*- impacts. This is perhaps not surprising, and likely reflects the pragmatic and financial difficulties experienced by those with a greater need to self-isolate, work from home or stop working all together, e.g. to care for others (Mak et al., 2021). Thus, in the absence of adequate social, housing, employment, health, carer and other support, such groups are likely to be particularly vulnerable to financial hardship, a pattern that has (arguably) been exacerbated by a decade of austerity policies in the UK (Sherpa, 2020; McKenzie, 2020; Scambler, 2020), which have eroded support and welfare systems and compounded existing inequalities (Marmot, 2020; Marmot et al., 2020). For example, a systematic literature review into the association between austerity and food insecurity in the UK ($n = 8$ papers included), found that austerity policies, including welfare reform, was associated with increased food insecurity and foodbank use (Jenkins et al., 2021).

Conversely, being younger showed an association with *social* but not *economic* impacts. This seems contrary to previous reports, which have fairly consistently shown that younger adults experienced greater job insecurity during the pandemic (Francis-Devine et al., 2021). One possible explanation may lie in the relatively affluent and educated nature of our sample, for whom parental support and comparatively high job security (amongst other factors) may have played a protective role with respect to *financial* impacts. Nonetheless, the finding of an association between age and *social* impacts is consistent with research that has shown elevated loneliness amongst the young, both before and during the pandemic (Czeisler et al., 2020). It is also in line with studies that have highlighted the importance of peer social relations to emerging adult development and wellbeing (Almquist, 2009; Almquist and Östberg, 2013; Menting et al., 2015; Modin et al., 2011), as well as recent concerns about the impact of social isolation during the pandemic amongst the young (Orben et al., 2020); see Foulkes and Blakemore (2021) also.

Having had a previous mental health difficulty was *also* associated with increased *social* but not *essential* impacts. This could again reflect (in part) the relative affluence of our sample, which may have afforded some protection against the economic (but not social) consequences of the pandemic amongst those with pre-existing mental health difficulties. Thus, the lockdown and restrictions in movement applied to *all* segments of society (in main part), i.e. irrespective of socioeconomic status, potentially exacerbating pre-existing patterns such as social withdrawal (e.g. for those who live alone) and interpersonal conflict (e.g. for those who cohabit) (Banerjee and Rai, 2020; Goodwin et al., 2020). Taken together these findings suggest that the social impacts of the pandemic may be felt most acutely amongst those for whom social connections are particularly crucial, most notably the young and those with mental health difficulties. Individuals with a greater number of children also reported higher social impacts, presumably reflecting the challenges of childcare/home-schooling and cohabiting with a large family in the context of a lockdown (Chandola et al., 2020).

Related to social aspects of the pandemic, another interesting finding to emerge is that whilst having neighbours that one can call upon in an emergency was protective against *essential impacts*, having neighbours that you can stop to chat to was protective against the *social impacts* of the pandemic and associated lockdown. This is consistent with the role of social cohesion/capital/connection in ameliorating the effects of adversity (De et al., 2005) including during the pandemic (Sommerlad et al., 2021), but also points to subtle differences in the types of support that may be needed when faced with different forms of adversity. On a very basic level, whilst an individual that is lonely (i.e. suffering from the *social* impacts of the pandemic) may crave those brief moments of connection when warm words are exchanged with a friendly neighbour, when an individual is faced with *financial* scarcity, e.g. following a loss of employment, what may be more crucial and protective is someone to turn to for a brief loan or a period of childcare (for example) in the context of an emergency.

With respect to the limitations of this study, its modest sample size raises the possibility that smaller effects were missed, and its cross-sectional design precludes inferences about causality. Further, the sample is heavily biased towards affluent, educated, white females, and as such, may be limited in its external validity. Whilst the over-representation of women in our sample is useful given that they have been shown to be disproportionately affected by the pandemic, we would argue that the main limitation of our study (and others') (Treweek et al., 2020), is the under-representation of BAME participants. Thus,

individuals from BAME groups have been shown to be disproportionately affected by the pandemic across a range of outcomes including infection rates, mortality (Pan et al., 2020; Patel et al., 2020; Iacobucci, 2020) and mental health (Fancourt et al., 2020; Pierce et al., 2021; Nandi and Platt, 2020). Other marginalised groups, including those with disabilities, have also been failed, including with respect to inclusion in research, media coverage and the UK government's response to the pandemic (Scior, 2020; Public Health England, 2020b). Future studies must therefore work harder to capture more representative samples of the population and/or purposefully over-sample marginalised groups.

Another limitation of the study is that the seven COVID-19 related impacts that we asked about may not have been *solely* attributable to the pandemic. We asked participants about their experience of stressors in the previous two weeks at a crucial, early stage of the pandemic/lockdown rather than explicitly asking about stressors *resulting* from the pandemic. Our reasoning for this was that it would be very hard (if not impossible) for participants to disentangle contextual factors that were or were not related to the pandemic, since almost no aspect of life was likely left untouched. Despite these limitations, we believe the study presents a useful snapshot of a range of potential stressors associated with increased impact at a critical period of the pandemic.

Finally, the self-report nature of the outcome data included may have led participants to under-report experienced levels of anxiety and depression, particularly in the context of existing stigma around mental health. Nonetheless, it is hoped that the online and anonymous nature of the study may have reduced the likelihood of any such effect.

5. Conclusions

The findings of this study are consistent with a growing body of evidence that suggests that the COVID-19 pandemic has interacted with -and exacerbated- existing inequalities, hitting more minoritized, marginalised and disempowered groups most severely (Blundell et al., 2020), even in a relatively affluent sample of the population. Examining a wide range of risk and protective factors, operating at multiple levels of scale, we show that *essential* and *social* impacts of the pandemic, which predict common mental health symptoms and caseness for generalised anxiety and depression, are unevenly distributed across the population, with women, young adults, carers, individuals with lower academic attainment and lower earnings particularly affected. As such, the findings highlight particular groups that should arguably represent the focus of policies and practices to help individuals recover from the effects of the pandemic (e.g. through targeted tax cuts and refunds, government grants and investment in welfare support to address essential impacts, and via investment in mental health services and strengthening of local community support networks to address social impacts), as well as preventative and/or reactive measures that might be implemented to try and ameliorate the effects of future pandemics or similar crises. More generally, the findings support calls for multidisciplinary research into the psychological, social and neuroscientific aspects of the pandemic, which are necessary if effective responses are to be taken and lessons to be learnt moving forward (Holmes et al., 2020).

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jad.2023.01.037.

CRediT authorship contribution statement

Marc S. Tibber: Conceptualization, Methodology, Formal Analysis and investigation, Writing – original draft presentation, Supervision; **Georgia Milne**: Conceptualization, Methodology, Formal Analysis and investigation, Writing – review and editing; **Peter Fonagy**: Conceptualization, Writing – review and editing; **Rob Saunders**: Formal Analysis and investigation, Writing – review and editing; **Tessa M. Dekker**: Conceptualization, Methodology, writing – review and editing; Supervision; Funding acquisition.

Funding

This research was supported by grants from the National Institute for Health Research (NIHR) Biomedical Research Centre (BRC) at Moorfields Eye Hospital NHS Foundation Trust and the UCL Institute of Ophthalmology; and from Moorfields Eye Charity (R160035A, R190029A, R180004A).

Conflict of interest

None.

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